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H4P PPG

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None

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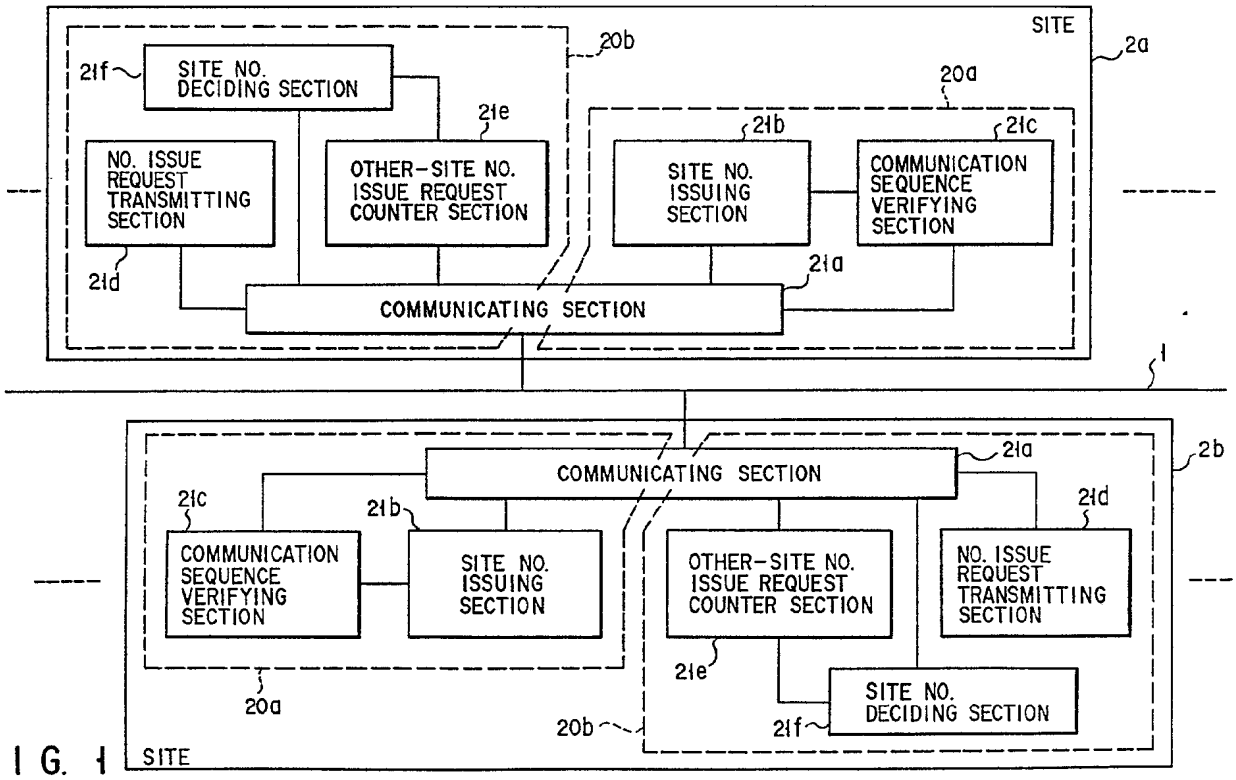
INT CL[5] H04L 12/08 12/18 12/28 12/40 12/42 12/44

(54) Allocating identifiers in a local area network

(57) In a distributed system where a plurality of sites (2a, 2b) broadcast data using a common communication line (1) for data processing, the object site is identified by its unique identifier. When multiple sites (2b) are newly participating in the distributed system in operation, unique identifiers are allocated to the individual new sites (2b), by the new sites sending requests to an existing station for issue of an identifier, counting the number of other sites sending requests before receipt of a message containing a series of identifier numbers from the existing site, and selecting an identifier from the message based on the count of other requesting sites. The message sent from the existing site contains as many identifier numbers as requests received from new sites.



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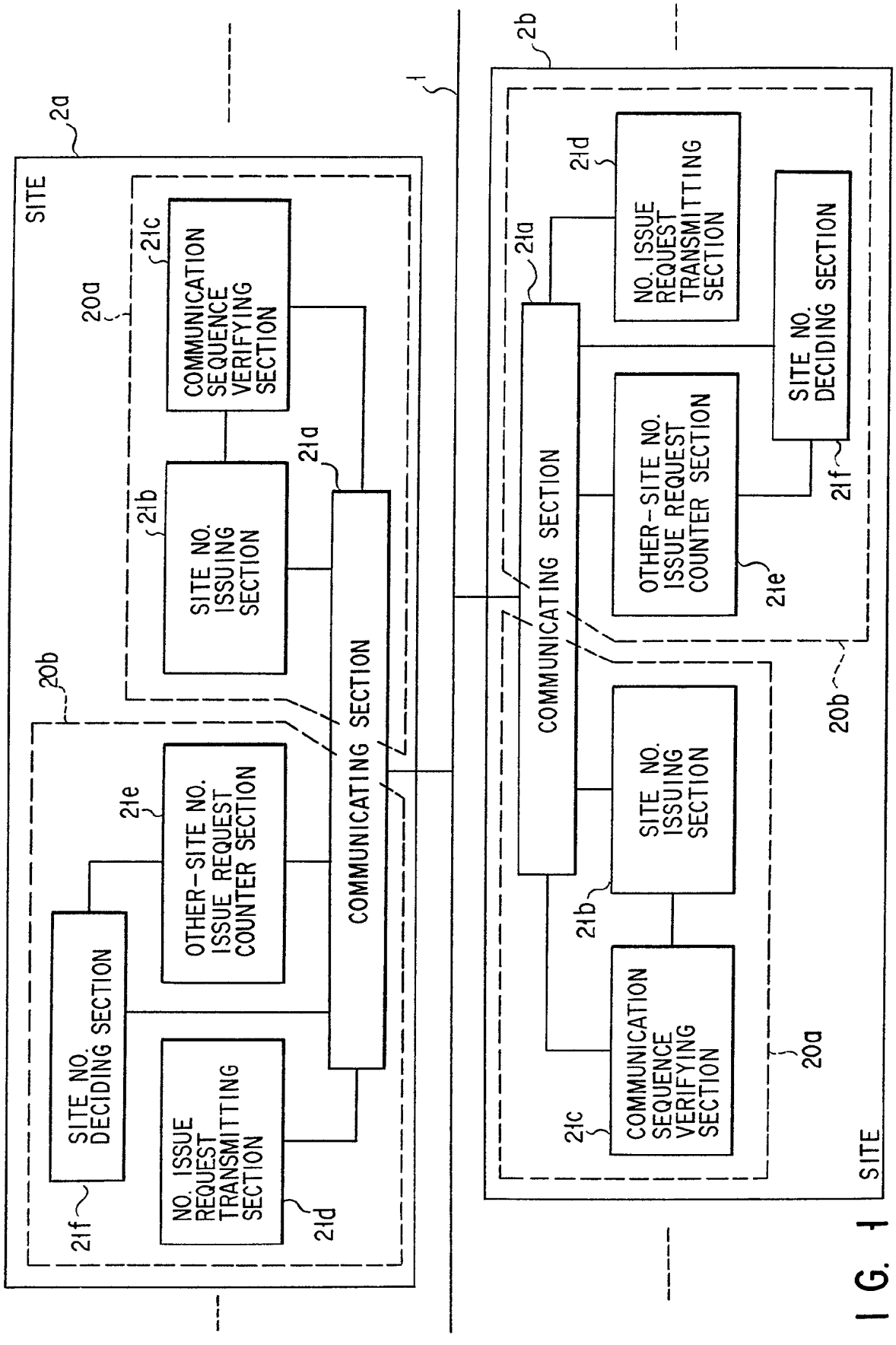

SITE
2a
20a
21c
COMMUNICATION SEQUENCE VERIFYING SECTION
21b
SITE NO. ISSUING SECTION
21a
COMMUNICATING SECTION
20b
21e
OTHER-SITE NO. ISSUE REQUEST COUNTER SECTION
SITE NO. DECIDING SECTION
21f
NO. ISSUE REQUEST TRANSMITTING SECTION
21d
1
2b
SITE
2a
20a
21c
COMMUNICATION SEQUENCE VERIFYING SECTION
21b
SITE NO. ISSUING SECTION
21a
COMMUNICATING SECTION
20b
21e
OTHER-SITE NO. ISSUE REQUEST COUNTER SECTION
SITE NO. DECIDING SECTION
21f
NO. ISSUE REQUEST TRANSMITTING SECTION
21d
2b

FIG. 1

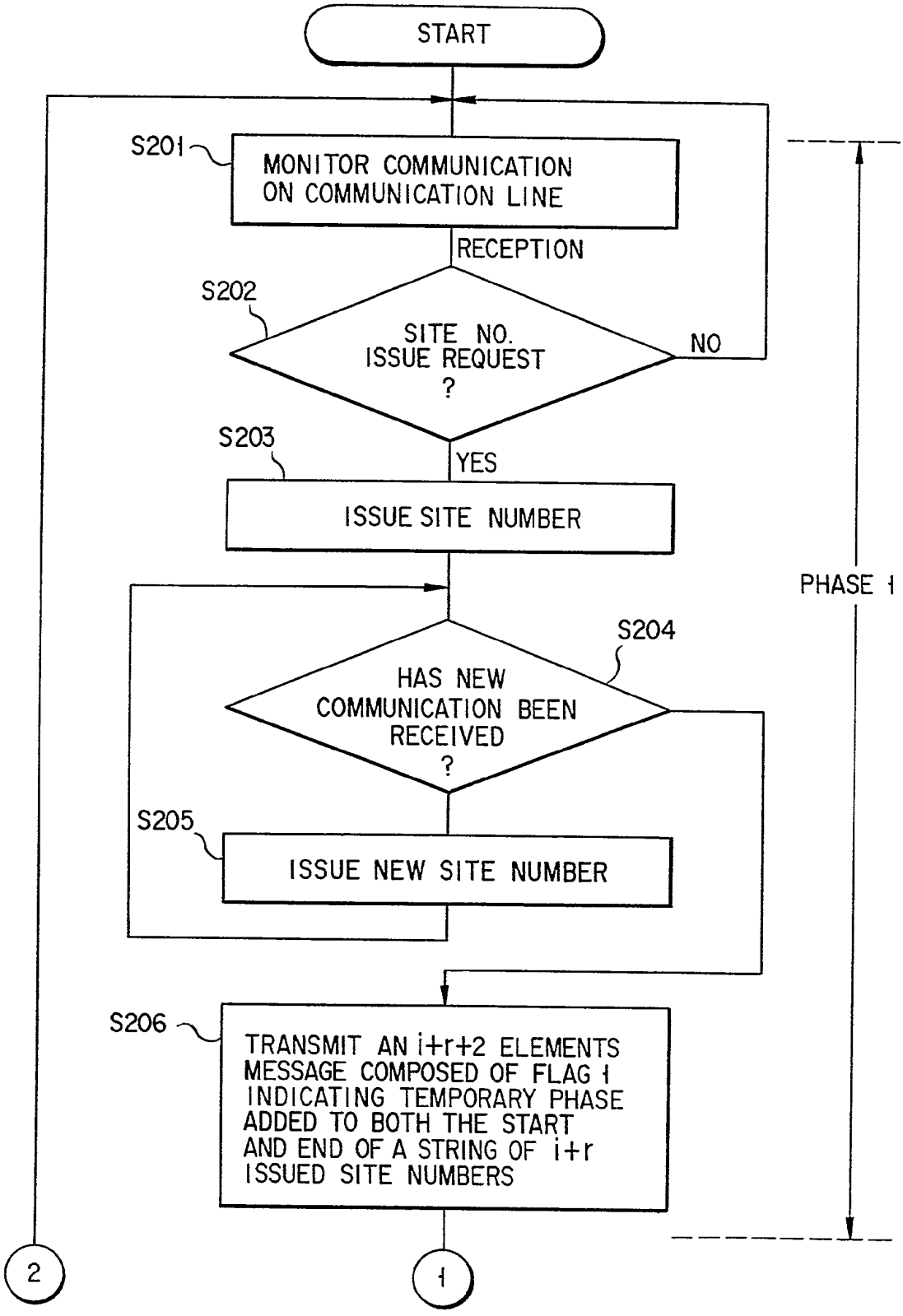

START
S201
MONITOR COMMUNICATION ON COMMUNICATION LINE
RECEPTION
S202
SITE NO. ISSUE REQUEST ?
NO
S203
YES
ISSUE SITE NUMBER
S204
HAS NEW COMMUNICATION BEEN RECEIVED ?
S205
ISSUE NEW SITE NUMBER
S206
TRANSMIT AN i+r+2 ELEMENTS MESSAGE COMPOSED OF FLAG 1 INDICATING TEMPORARY PHASE ADDED TO BOTH THE START AND END OF A STRING OF i+r ISSUED SITE NUMBERS
PHASE 1
2
1

FIG. 2A

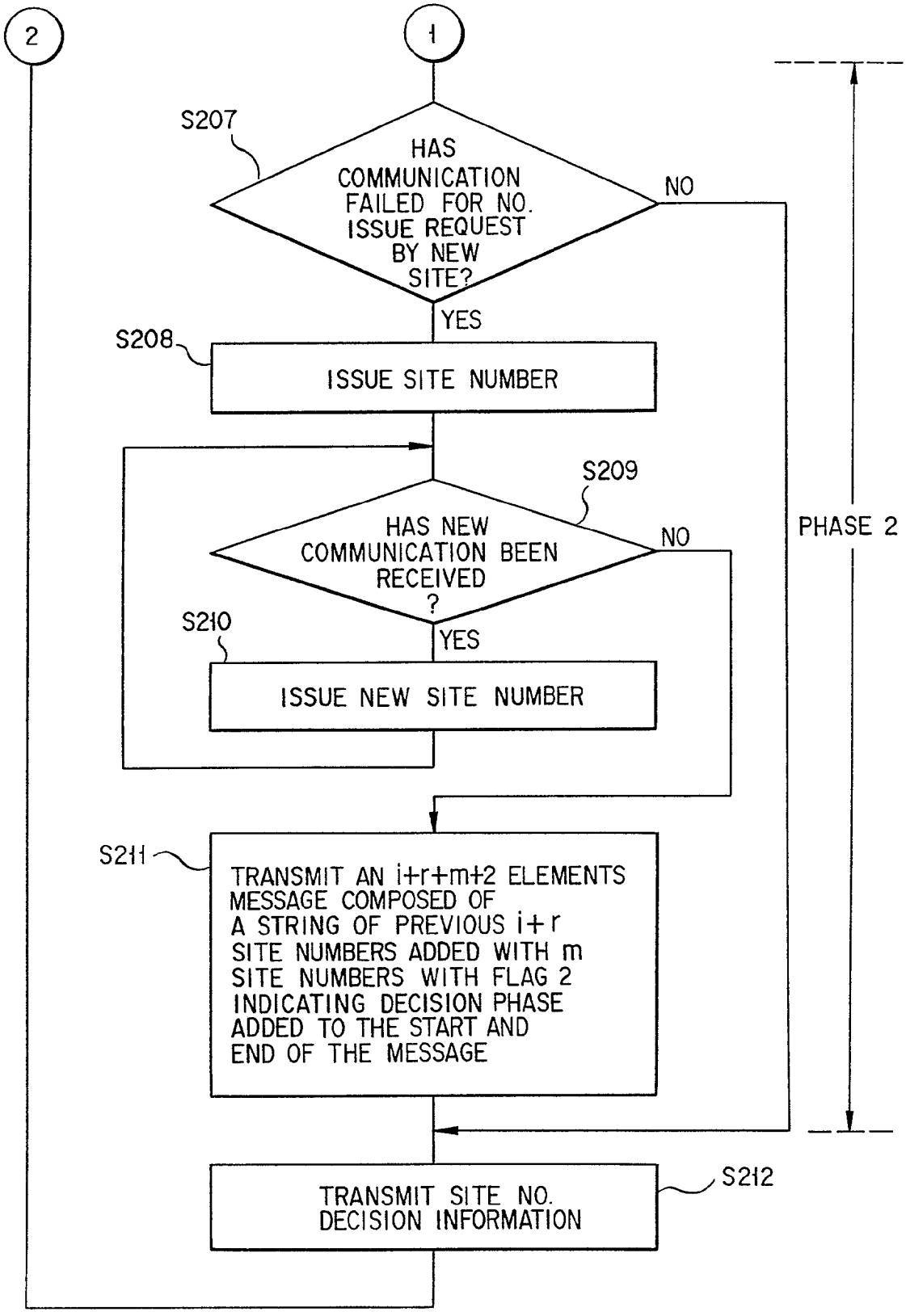

2
1
S207
HAS COMMUNICATION FAILED FOR NO. ISSUE REQUEST BY NEW SITE?
NO
YES
S208
ISSUE SITE NUMBER
S209
HAS NEW COMMUNICATION BEEN RECEIVED ?
NO
S210
YES
ISSUE NEW SITE NUMBER
PHASE 2
S211
TRANSMIT AN i+r+m+2 ELEMENTS MESSAGE COMPOSED OF A STRING OF PREVIOUS i+r SITE NUMBERS ADDED WITH m SITE NUMBERS WITH FLAG 2 INDICATING DECISION PHASE ADDED TO THE START AND END OF THE MESSAGE
S212
TRANSMIT SITE NO. DECISION INFORMATION

FIG. 2B

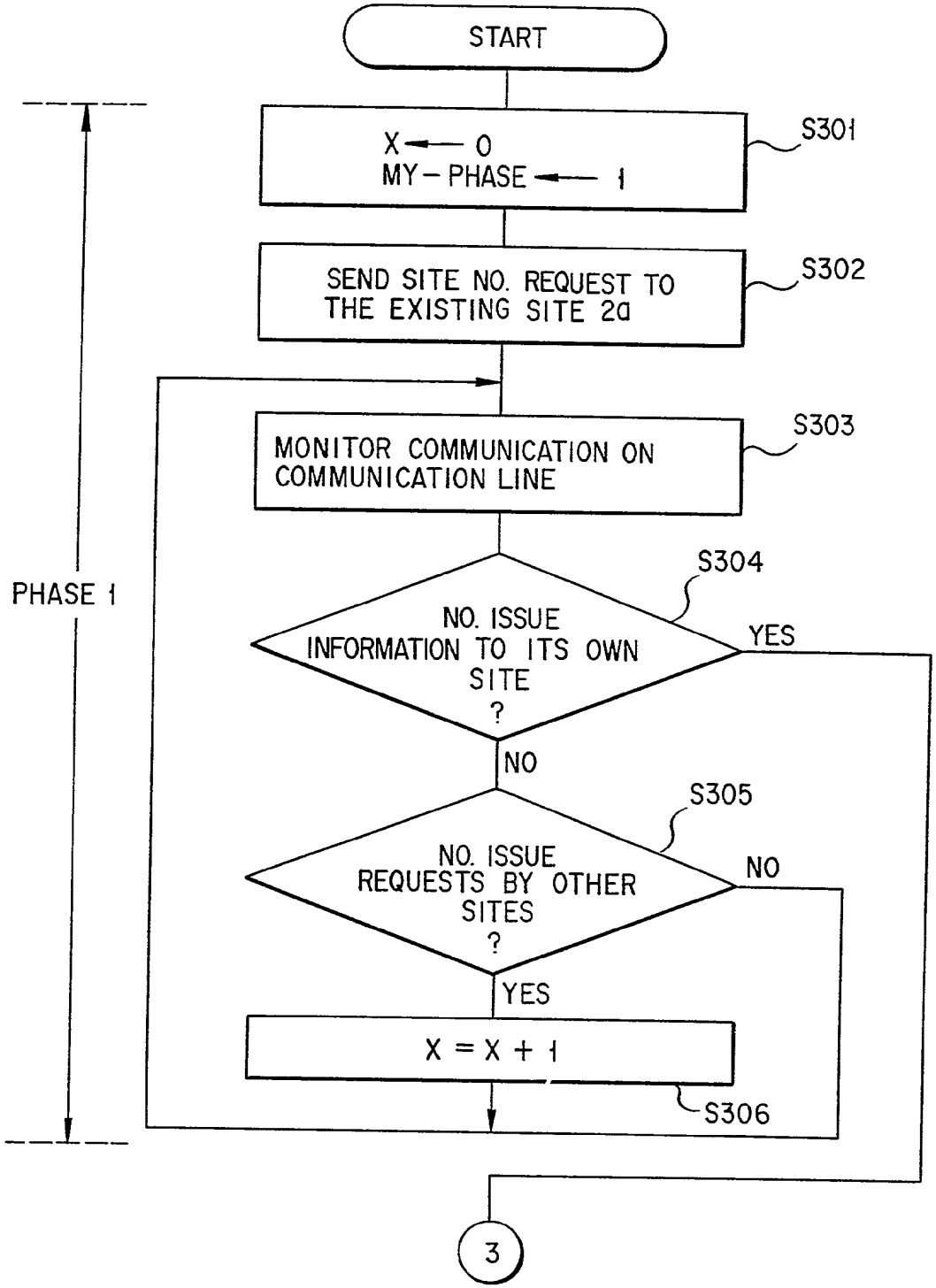

START
X ← 0
MY-PHASE ← 1
S301
SEND SITE NO. REQUEST TO THE EXISTING SITE 2a
S302
MONITOR COMMUNICATION ON COMMUNICATION LINE
S303
NO. ISSUE INFORMATION TO ITS OWN SITE ?
S304
YES
NO
NO. ISSUE REQUESTS BY OTHER SITES ?
S305
NO
YES
X = X + 1
S306
PHASE 1
3

FIG. 3A

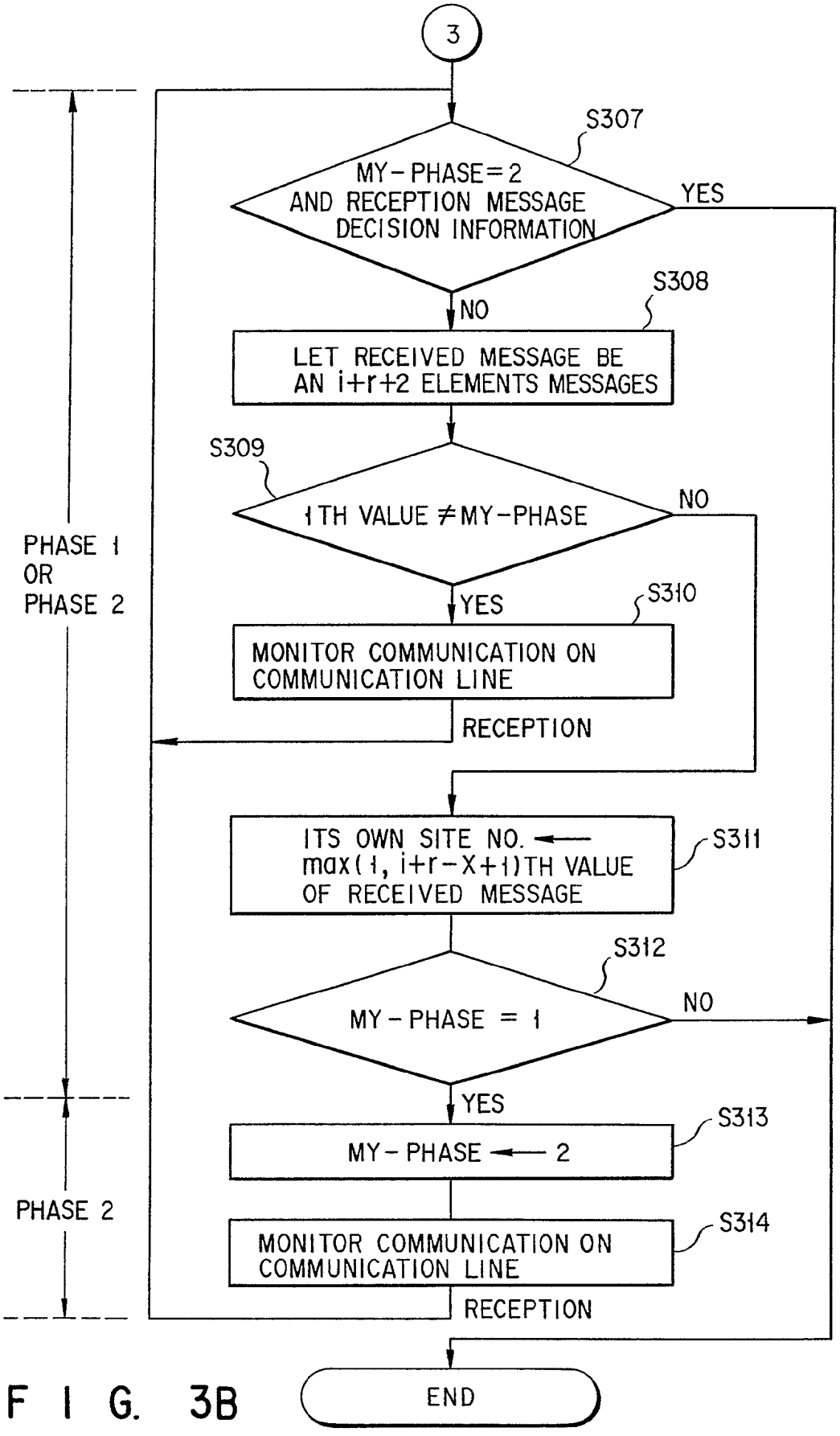

3
S307
MY-PHASE=2 AND RECEPTION MESSAGE DECISION INFORMATION
YES
NO
S308
LET RECEIVED MESSAGE BE AN i+r+2 ELEMENTS MESSAGES
S309
1TH VALUE ≠MY-PHASE
NO
YES
S310
MONITOR COMMUNICATION ON COMMUNICATION LINE
RECEPTION
ITS OWN SITE NO. ← max(1, i+r-X+1)TH VALUE OF RECEIVED MESSAGE
S311
S312
MY-PHASE = 1
NO
YES
S313
MY-PHASE ← 2
S314
MONITOR COMMUNICATION ON COMMUNICATION LINE
RECEPTION
PHASE 1 OR PHASE 2
PHASE 2
END

FIG. 3B

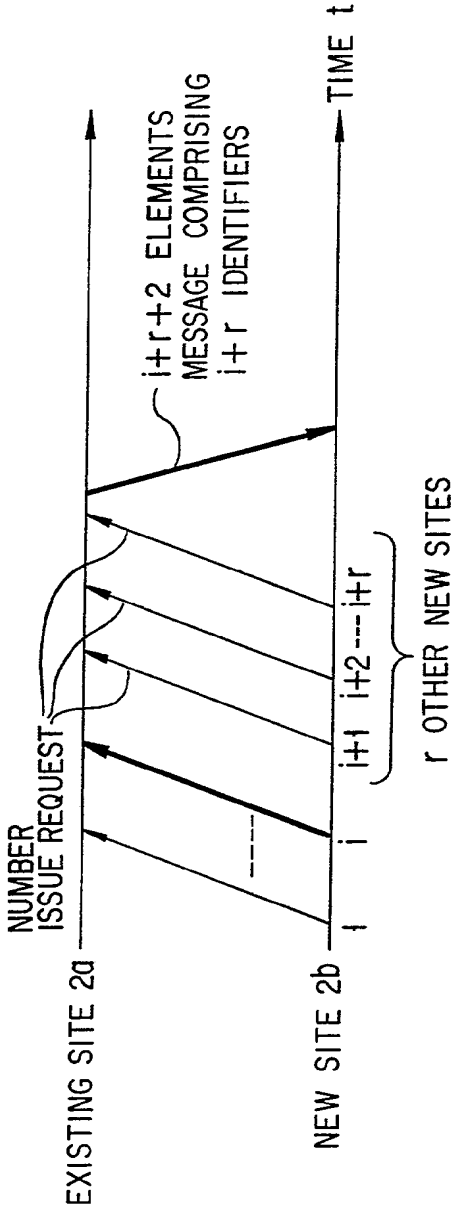

NUMBER ISSUE REQUEST
EXISTING SITE 2a
NEW SITE 2b
i+r+2 ELEMENTS MESSAGE COMPRISING i+r IDENTIFIERS
TIME t
t
i
i+1
i+2
i+r
r OTHER NEW SITES

FIG. 4

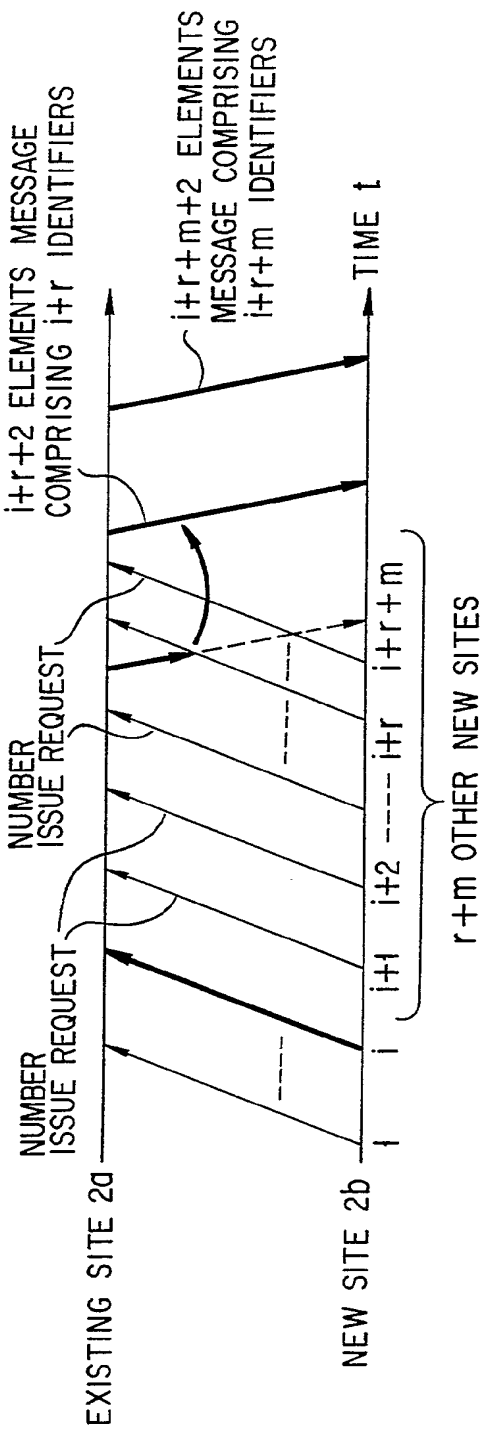
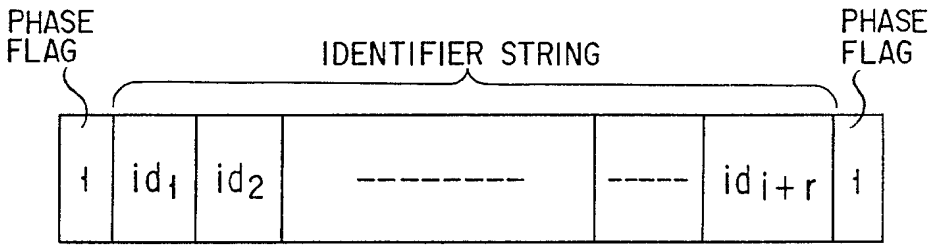

NUMBER ISSUE REQUEST
NUMBER ISSUE REQUEST
EXISTING SITE 2a
NEW SITE 2b
i+r+2 ELEMENTS MESSAGE COMPRISING i+r IDENTIFIERS
i+r+m+2 ELEMENTS MESSAGE COMPRISING i+r+m IDENTIFIERS
TIME t
t
i
i+1
i+2
i+r
i+r+m
r+m OTHER NEW SITES

FIG. 5


PHASE FLAG
IDENTIFIER STRING
PHASE FLAG
1
id1
id2

-----
id i+r
1

FIG. 6

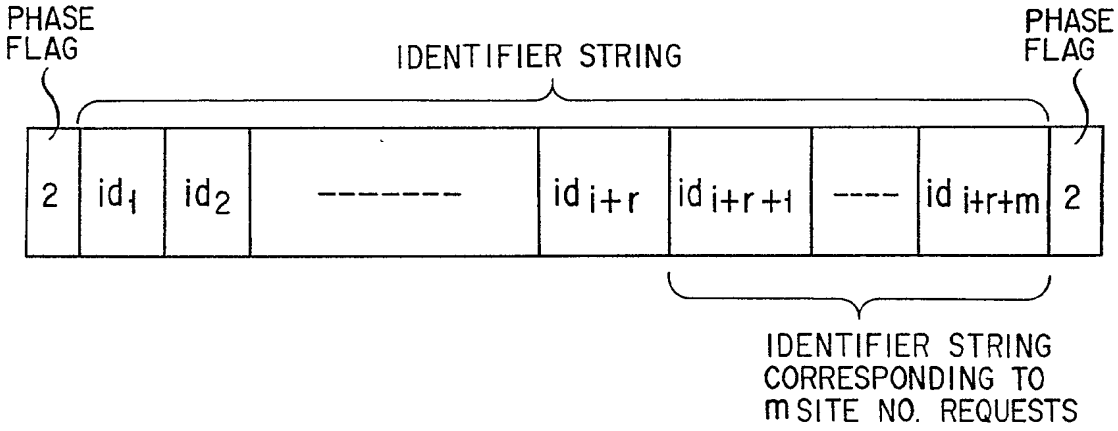

PHASE FLAG
IDENTIFIER STRING
PHASE FLAG
2
id1
id2
----
id i+r
id i+r+1
----
id i+r+m
2
IDENTIFIER STRING CORRESPONDING TO m SITE NO. REQUESTS

FIG. 7

"METHOD OF ALLOCATING IDENTIFIERS AND APPARATUS FOR THE SAME"

The present invention relates to a method of allocating identifiers for use in a distributed system using a LAN based on a broadcasting communication such as a typical Ethernet (trade name) and an apparatus for the same.

A distributed system using a local area network (LAN) is typical of distributed or parallel processing systems by a plurality of computers. In such a distributed system, the physical distances between computers (sites) constituting the system are limited to a relatively short distance. However, since the system of this type not only provides a communication line with a sufficient capacity but also allows use of most of existing techniques, the system can be easily constructed. For this reason, the distributed system using a LAN have been developed in various places and put to practical use. In the distributed system, an identifier such as a site number, i.e., a unique number assigned to each site, is generally used to identify each site. Under this site identifying method, it is required that a new identifier is allocated to a new site when the new site enters the system.

Various conventional methods of allocating identifiers have been proposed. Those conventional identifier allocation methods are based on the assumption that the

individual sites are physically connected to each other with the n(n-1)/2 number of lines where n is the number of cites and, for example, that site i can communicate only with site j by specifying a communication port of the site j through one of the lines.

However, since, in the distributed system using a LAN based on a broadcasting communication a typical of which is Ethernet, each site broadcasts the same information to the other sites, the above assumption will not be hold. Therefore, conventional identifier allocation methods cannot be applied to LAN-based distributed systems. This is because, in such distributed systems, new sites to which no identifiers have been assigned enter into the system almost at the same time, it is impossible to inform each new site separately of the identifier assigned to that new site through the communication line. That is, in conventional identifier allocation methods, only one site to which no identifier has been assigned can exist at the same time in the distributed system. For this reason, in the system using the LAN based on the broadcasting communication, for example, newly entering sites have been assigned identifiers beforehand and the users activates the desired sites using the assigned identifiers. This conventional method requires much time to allocate the identifiers and also raises some problems such as the issuing duplicate identifiers and the vulnerability to

unauthorized entering.

Accordingly, an object of the present invention is to provide a method of allocating identifiers to new sites even when a plurality of new sites enter almost at the same time a system which is in operation and composed of a plurality of sites having the same broadcasting and receiving functions and an apparatus for the same.

According to an aspect of the present invention, there is provided a method of allocating identifiers to individual sites in a communication system where a plurality of sites are connected to each other through a communication line and a data communication which uses exclusively the communication line is carried out by specifying an object site using a unique identifier allocated to the object site, comprising the steps of broadcasting an identifier issue request on the communication line by each site newly participating in the communication system, broadcasting an identifier string of unique identifiers not yet allocated and arranged in reception order on the communication line by one of the existing sites that has received the identifier issue request on the communication line, and counting the number of identifier issue request broadcasted from other new sites by each new site during the time from when that new site broadcasts the identifier issue request until it receives the identifier string,

and selecting the unique identifier allocated to itself from the identifier string based on the count by each new site.

According to another aspect of the present invention, there is provided a method of allocating identifiers to individual sites in a communication system where a plurality of sites are connected to each other through a communication line and a data communication which uses exclusively the communication line is carried out by specifying an object site using a unique identifier allocated to the object site, comprising the steps of broadcasting an identifier issue request on the communication line by each site newly participating in the communication system, broadcasting a first identifier string of unique identifiers not yet allocated and, arranged in the reception order on the communication line by one of the existing sites that has received the identifier issue request on the communication line, counting the number of the identifier issue requests by the one of the existing sites when receiving identifier issue requests from other new sites during the time from when the one of the existing sites has received the previous identifier issue request unit it broadcasts the first identifier string and broadcasting a second identifier string composed of as many identifiers as the count added to the first identifier string onto the communication line by the one of the existing sites,

and counting the number of identifier issue requests from the other new sites by each new site during the time from when each new site broadcasts the identifier issue request until it receives the second identifier string, and selecting the unique identifier allocated to itself from the second identifier string based on the count by the each new site.

According to still another aspect of the present invention, there is provided an apparatus for allocating identifiers to individual sites for use in a communication system where a plurality of sites are connected to each other through a communication line and a data communication which uses exclusively the communication line is carried out by specifying an object side using a unique identifier allocated to the object site, comprising means for connecting each site to the communication line, monitoring communications on the communication line, and broadcasting and receiving data through the communication line, means for broadcasting a site identifier issue request through the connecting means to the communication line, means for counting the number of site identifier issue requests broadcasted from other new sites to the communication line until its own new site receives an identifier string after the new site broadcasts a site identifier issue request, means for verifying the sequence of site identifier issue requests broadcasted on the communication line, means

for arranging an identifier message under the control of the verifying means, and issuing the identifier message on the communication line through the connecting means, and means for deciding a unique identifier allocated to the new site from the identifier message received from the communication line under the control of the counting means.

With the present invention, an identifier issuing site receives identifier issue requests broadcasted from other new sites during the time from when it has received an identifier issue request from a new site until it broadcasts a unique identifier, counts the number of the identifier issue requests, and broadcasts as many identifiers as the count. At the same time, the new site counts the number of identifier issue requests broadcasted from the other new sites during the time from when it has broadcasted an identifier issue request until it receives a unique identifier, and decides a unique identifier allocated to itself based on the count. Therefore, it is possible to allocate identifiers even when a plurality of new sites almost simultaneously participate in the system in operation.

This invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a block diagram showing a part of an apparatus for allocating identifiers according to an

embodiment of the present invention;

Figs. 2A and 2B are flowcharts for explaining procedures of allocating identifiers in an existing site of Fig. 1 when taken together;

Figs. 3A and 3B are flowcharts for explaining procedures of allocating identifiers in a new site of Fig. 1 when taken together;

Figs. 4 and 5 are diagrams for explaining respectively the procedures of allocating identifiers with respect to time;

Fig. 6 is a diagram showing an identifier string issued from the existing site; and

Fig. 7 is a diagram showing another identifier string issued from the existing site.

A method of allocating identifiers and an apparatus for the same according to the present invention will be explained referring to the accompanying drawings.

Fig. 1 is a block diagram showing a part of an apparatus for allocating identifiers according to the embodiment of the present invention. For a communication system to which the present invention is applied, it is assumed that the system operates as a broadcasting communication like Ethernet when it is in communication without specifying a site number and that as long as a communication is in progress, the communication uses exclusively the communication line to prohibit any other communications. It is also assumed that the system is

equipped with a collision avoidance of communications on the communication line. In the present invention, site numbers are considered to be identifiers hereinafter.

As shown in Fig. 1, a plurality of sites 2a with equal transmitting and receiving functions are connected to a communication line (bus) 1. The sites 2a have already been assigned unique site numbers serving as identifiers and have participated in the communication system (referred to as the existing sites hereinafter). On the other hand, sites 2b have not been assigned unique site numbers yet and are about to participate in the communication system (referred to as new sites hereinafter). For the sake of simplicity, only one existing site 2a and one new site 2b are shown in Fig. 1. The existing site 2a comprises an identifier issuing section 20a having the function of issuing new site numbers, and an identifier issue request section 20b having the function of requesting the issue of a new site number. The identifier issuing section 20a includes a communicating section 21a for connecting the site to the communication line 1 and always monitoring communications on the communication line 1, a site number issuing section 21b for forming and issuing a site number message for the new sites 2b, and a communication sequence verifying section 21c for verifying and storing the sequence of identifier issue requests which a plurality of new sites 2b have broadcasted on the communication

line 1. The identifier issue request section 20b includes the communicating section 21a described above, a number issue request transmitting section 21d for broadcasting site number issue request for its own site on the communication line 1, an other-site number issue request counting section 21e for counting the number of number issue requests broadcasted by the other sites during the time from when its own site broadcasts a number issue request to the communication line 1 until it receives an identifier message, and a site number deciding section 21f for deciding its own site number from the sequence of identifiers received on the basis of the output of the other-site number issue request counting section 21e. For simplicity's sake, a description of the remaining construction necessary for data broadcast and reception over a LAN will be omitted. Although the new site 2b has the same construction as that of the existing site 2a, the identifier issuing section 20a operates in the latter, whereas the identifier issue request section 20b operates in the former. Of the existing sites 2a that have received number issue requests, for example, the site with the smallest site number (address) can broadcast site numbers from its own identifier issuing section 20a. In Fig. 1, all existing sites 2a have the same construction with a number issuing function, but they may be logically constructed so that only a particular single existing site 2a may

execute a site number issuing function.

Figs. 2A and 2B are flowcharts for explaining procedures of allocating identifiers in an existing site 2a of Fig. 1. Any number issuing method may be used as long as a number other than the numbers already allocated to the other sites in the system can be issued. For example, there is a method in which a number is incremented one by one. In Fig. 2A, after the system is started, the communicating section 21a in the existing site 2a always monitors the communications on the communication line 1 (S201). The site number issuing section 21b determined whether the monitored communications are site number issue requests (S202). When it is not true, the communicating section 21a continues monitoring the communications on the communication line 1 (S201). On the other hand, when it is true, the site number issuing section 21b prepares for response, issuing, i.e., broadcasting site numbers (S203). Then, for example, as shown in Fig. 4, it is determined whether the communicating section 21a of the existing site 2a has received number issue requests from r other new sites 2b added to the communication system during the time from when the i th new site 2b broadcasts a number issue request at a step S202 until the existing site 2a issues i.e., broadcasts new site numbers (S204). If it is true, the site number issuing section 21b of the existing site 2a broadcasts site numbers in response to the number issue request

under the control of the communication sequence verifying section 21c (S205). If it is not true, the site number issuing section 21b broadcasts site numbers in the order of reception to form an identifier string of total i+r site numbers. Then, as shown in Fig. 6, the section 21b broadcasts as a response an i+r+2 elements message where phase flag "1" (i.e., phase "1") representing a temporary phase of the site number is added to both the beginning and end of the site number string (S206). The i+r+2 elements message is defined as a message consisting of i+r+2 elements, the sum of i+r identifiers and two phase flags. The communicating section 21a broadcasts the message through the communication line 1.

Referring to Fig. 2B, an explanation will be made of the collision in the existing site 2a of the number issue request broadcasted from the new site 2b and the site number broadcasted from the existing site 2a when another m new sites 2b broadcasts number issue requests as shown in Fig. 5, during the time from when the site number issuing section 21b of the existing site 2a asks the communicating section 21a to broadcast an i+r+2 elements message to the communication line 1 until the message is broadcasted to the communication line 1. In Fig. 2B, when another m new sites 2b broadcasts number issue requests after i+r new sites have broadcasted the number issue requests, it is determined whether the

broadcasting of an i+r+2 elements message to the communication line 1 from the communication section 21a has failed by the collision due to m number issue requests (S207). If the transmission fails for that m number issue requests, new site numbers are issued in the same procedures as described above (S208, S209, S210). As a result, the site number issuing section 21b of the existing site 2a adds a string of the current m site numbers to the previous string of i+r site numbers under the control of the communication sequence verifying section 21c, and then further adds phase flag "2" to both the beginning and end of the resulting site number string to broadcast as a response an i+r+m+2 elements message, as shown in Fig. 7. Then, the communicating section 21a of the existing site 2a rebroadcasts the message onto the communication line 1 (S208). A site number decision information in broadcasted to the communication line 1. Phase flag "2" indicates that the site numbers in the site number string are the final decisions for the individual sites. The sensing of collisions and rebroadcasting of site number strings are automatically executed by the hardware of the existing site 2a. The new sites 2b can know from the value "2" of the phase flag that the rebroadcasting has been executed. Following a step S208 or at a step S207, when there is no collision or failure in broadcasting, a site number decision information is broadcasted to the

communication line 1 (S212). This completes the procedures of allocating identifiers at the existing site 2a.

Figs. 3A and 3B are flowcharts for explaining procedures of allocating identifiers in a new site 2b of Fig. 1. In Fig. 3A, the new site 2b initializes the count X of its other-site number issue request counting section 21e to "0" before requesting the issue of site number and sets its phase flag (my phase) to "1" in order to indicate that the site number allocating procedure is in an initial stage (S301). After this, the number issue request section 21d broadcasts a site number issue request to the existing site 2a via the communicating section 21a and communication line 1 (S302). The communicating section 21a of the new site 2b starts to monitor the communications on the communication line 1 in order to receive a response message from the exiting site 2a (S303). The communicating section 21a determines whether there is a number issue information for its own new site 2b in the monitored message (S304). That is, it is determined whether the value of the phase flag in the first number is "1". If it is not true, when the other new sites 2b broadcasts the site number issue requests (S305), the other-site number issue request counting section 21e counts the number of those site number issue requests, replacing the count X with X+1 each count (S306). When there is no number issue requests from the other sites, it waits until a number

issue information for its own new site 2b is received (S304).

In Fig. 3B, when the existing site 2a broadcasts again a temporarily allocated site number in the procedure explained in Fig. 2A, it is determined whether the phase flag (my phase) is "2" and the received message includes a site number decision information (S307). If the decision information is included, the procedures are completed. If not, the received message is made to be an i+r+2 elements message composed of i+r site numbers allocated to the new sites including itself and two phase flag "1"s (S308). Here, it is determined whether the communication section 21a has received the message whose phase flag is "2" (S309). When the phase flag is "1", monitoring the communications on the communication line 1 is continued (S310). On the other hand, when the message whose phase flag is "2" is received at a step S309 (S309), the site number deciding section 21f searches its own site number candidate based on the count X of the counter corresponding to the number of the number issue requests broadcasted by the other sites (S311). As shown in Fig. 6, it is assumed that the i+r-X+1 th number from the beginning of the i+r+2 elements message, i.e., the X+2 th number from the end of the message is a temporary site number allocated to its own new site 2b. Here, it is determined whether the phase flag (my phase) is "1" (S312). When the phase

flag is "2", the procedures are completed. On the other hand, when the phase flag is "1", the message is ignored. Because the procedures proceed to a final decision step, its own phase flag is set to "2" (S313). The communicating section 21a restart to monitor the communications on the communication line 1 (S314). In this state, procedures go back to a step S307, and waits for a reception message decision information from the existing site 2a to come because the phase flag is "2". The same procedures are repeated until a decision information is received. At a step S307, when a decision information is received, it is determined that the site number obtained until then is its own site number. This completes the process.

With the present invention, it is possible to allocate site numbers even when a plurality of new sites participate in the communication system in operation. Because both the new sites and the existing sites can check the identifiers and also check the number of participants using a counter, an unauthorized entry in the communication system can be prevented.

Claims:

1. A method of allocating identifiers to individual sites in a communication system where a plurality of sites are connected to each other through a communication line and a data communication which uses exclusively said communication line is carried out by specifying an object site using a unique identifier allocated to said object site, comprising the steps of:

broadcasting an identifier issue request on said communication line by each site newly participating in said communication system;

broadcasting an identifier string of unique identifiers not yet allocated and arranged in reception order on said communication line by one of the existing sites that has received said identifier issue request on said communication line; and

counting the number of identifier issue requests broadcasted from other new sites by each new site during the time from when that new site broadcasts said identifier issue request until it receives said identifier string, and selecting the unique identifier allocated to itself from said identifier string based on the count by each new site.

2. A method of allocating identifiers to individual sites in a communication system where a plurality of sites are connected to each other through a communication line and a data communication which uses

exclusively said communication line is carried out by specifying an object site using a unique identifier allocated to said object site, comprising the steps of:

broadcasting an identifier issue request on said communication line by each site newly participating in said communication system;

broadcasting a first identifier string of unique identifiers not yet allocated and arranged in the reception order on said communication line by one of the existing sites that has received said identifier issue request on said communication line, counting the number of the identifier issue requests by said one of the existing sites when receiving identifier issue requests form other new sites during the time from when said one of the existing sites has received said previous identifier issue request until it broadcasts said first identifier string and broadcasting a second identifier string composed of as many identifiers as the count added to said first identifier string onto said communication line by said one of the existing sites; and

counting the number of identifier issue requests from the other new sites by each new site during the time from when each new site broadcasts said identifier issue request until it receives said second identifier string, and selecting the unique identifier allocated to itself from said second identifier string based on the count by said each new site.

3. An apparatus for allocating identifiers to individual sites for use in a communication system where a plurality of sites are connected to each other through a communication line and a data communication which uses exclusively said communication line is carried out by specifying an object side using a unique identifier allocated to said object site, comprising:

means for connecting each site to said communication line, monitoring communications on said communication line, and transmitting and receiving data through said communication line;

means for broadcasting a site identifier issue request through said connecting means to said communication line;

means for counting the number of site identifier issue requests transmitted from other new sites to said communication line until its own new site revives an identifier string after said new site broadcasts a site identifier issue request;

means for verifying the sequence of site identifier issue requests transmitted on said communication line;

means for arranging an identifier message under the control of said verifying means and issuing said identifier message on said communication line through said connecting means; and

means for deciding a unique identifier allocated to said new site from said identifier message received from

said communication line under the control of said counting means.

4. A method of allocating identifiers, substantially as hereinbefore described with reference to the accompanying drawings.

5. An apparatus for allocating identifiers, substantially as hereinbefore described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number

9124255.2

Relevant Technical fields

(i) UK Cl (Edition K) H4P PPF, PPG

(ii) Int Cl (Edition 5) H04L 12/08, 18, 28, 40, 42, 44

Search Examiner

S J DAVIES

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

25 MARCH 1992

Documents considered relevant following a search in respect of claims 1-3

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
	NONE	

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

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